MISSION ADAPTIVE UAS PLATFORM FOR EARTH SCIENCE RESOURCE ASSESSMENT

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ABSTRACT:

NASA Ames Research Center has led a number of important Earth science remote sensing missions including several directed at the assessment of natural resources. A key asset for accessing high risk airspace has been the 180 kg class SIERRA UAS platform, providing mission durations of up to 8 hrs at altitudes up to 3 km. Recent improvements to this mission capability are embodied in the incipient SIERRA-B variant. Two resource mapping problems having unusual mission characteristics requiring a mission adaptive capability are explored here.

One example involves the requirement for careful control over solar angle geometry for passive reflectance measurements. This challenges the management of resources in the coastal ocean where solar angle combines with sea state to produce surface glint that can obscure the ocean color signal. Furthermore, as for all scanning imager applications, the primary flight control priority to fly the UAS directly to the next waypoint should compromise with the requirement to minimize roll and crab effects in the imagery. A second example involves the mapping of natural resources in the Earth's crust using precision magnetometry. In this case the vehicle flight path must be oriented to optimize magnetic flux gradients over a spatial domain having continually emerging features, while optimizing the efficiency of the spatial mapping task.

These requirements were highlighted in several recent Earth Science missions including the October 2013 OCEANIA mission directed at improving the capability for hyperspectral reflectance measurements in the coastal ocean, and the Surprise Valley Mission directed at mapping sub-surface mineral composition and faults, using high-sensitivity magentometry. This paper reports the development of specific aircraft control approaches to incorporate the unusual and demanding requirements to manage solar angle, aircraft attitude and flight path orientation, and efficient (directly geo-rectified) surface and sub-surface mapping, including the near-time optimization of these sometimes conflicting requirements.

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